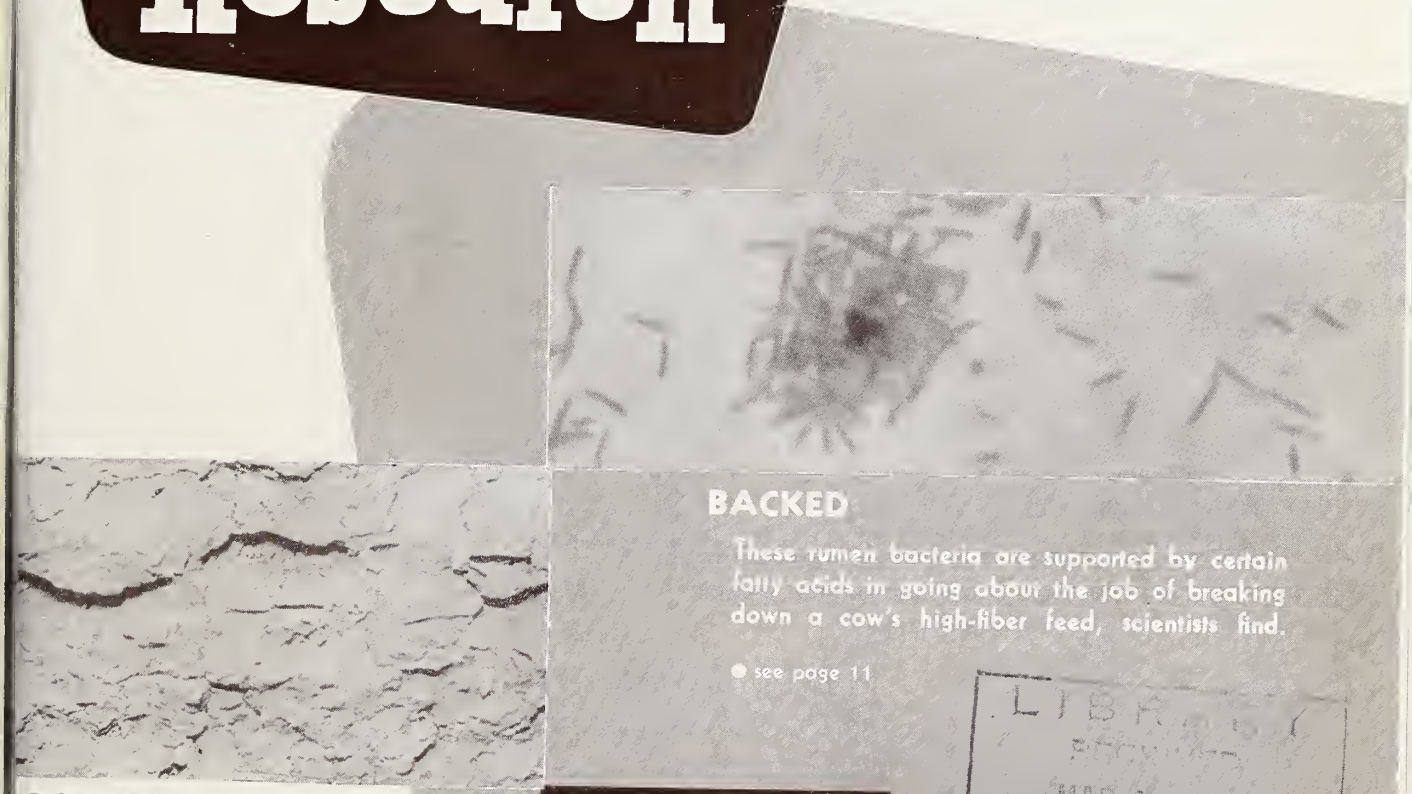
Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

1.98
Ag 84
v.4 p.2

AGRICULTURAL Research

FEBRUARY 1955



BACKED

These rumen bacteria are supported by certain fatty acids in going about the job of breaking down a cow's high-fiber feed, scientists find.

● see page 11

LIBRARY
MAR 3 1955
U. S. DEPARTMENT OF AGRICULTURE
BELTSVILLE BRANCH

PACKED

Tight soil layers will soon get the research attention this serious problem needs.

● see page 4

STACKED

You're looking at the Beltsville broiler: it grows fast, feathers out quickly, is easy to dress.

● see page 8

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL
Research

Vol. 3—February 1955—No. 8
Joseph F. Silbaugh—Managing Editor
John R. Deatherage—Assistant Editor

CONTENTS

Information in this periodical is public property and may be reprinted without permission. Mention of the source will be appreciated but it is not required.

Good buy

American industry has a productive capacity today that would have seemed miraculous 30 years ago. Its high efficiency has become proverbial. We all know that our factories now turn out more and better industrial products than ever before, with relatively less expenditure of human effort.

Many people may not realize, however, that the past 30 years has seen an equally vast improvement in *agricultural* production. Farmers, too, are much more efficient than they were in the 1920's. And the industries that process and distribute farm-grown foods have achieved near-miracles of their own in giving consumers better products and services.

Because of progress in farming and in the system that puts the fruits of agriculture on family tables, an hour's labor today buys more and better food than at any time in history.

The 1955 market basket—filled with a typical family's food for a week—would look strange to a housewife of three decades ago. But she would soon see its advantages. It contains *more protective foods*—such as meat, milk, eggs, fruit, green vegetables—than the average week's supply for the same size family in 1925. It offers a *greater variety* of foods, many in ready-to-cook form. And today's food has *higher nutritive* value.

Even so, filling this basket each week takes no larger share of a family's net earnings now than it did 30 years ago. At that time, food cost us about one-fourth of our spendable income. Almost exactly the same percentage of our paychecks goes for food today. Yet the things it buys are greatly improved in quality and in convenience.

Looked at in another way, the kind of food that cost 25 percent of our take-home pay in the 1920's could be bought today for only 17 percent of our present pay. But, as Assistant Secretary of Agriculture Earl L. Butz said recently, "We are eating a lot higher on the hog nowadays."

All engaged in agricultural research, and in the teaching, extension, and other educational work that helps agriculture produce more abundantly and more efficiently, can be proud to share with farmers and industry the credit for making food the *good buy in better eating* that it is today.

Agricultural Research is published monthly by the Agricultural Research Service, United States Department of Agriculture, Washington 25, D. C. The printing of this periodical was approved by the Director of the Bureau of the Budget on August 19, 1952. Yearly subscription rate is $1 in the United States and countries of the Postal Union, $1.35 in other countries. Single copies are 15 cents each. Subscription orders should be sent to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

Golden year for a golden resource

FOREST SERVICE HAS MANY RESEARCH ACHIEVEMENTS

GOLDEN ANNIVERSARY — traditional name for a 50-year landmark—well fits the observance of the fiftieth birthday of USDA's Forest Service, February 1, 1955. Only the soil and water outrank forests as our richest natural resources.

After Columbus' landing in 1492, about 400 years passed before concern was felt to protect, manage, and develop our forests and related resources. In those centuries, whole areas were stripped of trees. Timber was cut for profit or need, rarely with thought for the future.

In 1876, USDA launched some limited forestry work. In 1891 the first National Forests were set apart. Then, in 1905, the Forest Service was established to administer the National Forests and do research and teach wise management of forests and wild lands. With these large assignments began the organized effort to make forests yield maximum benefits for the people. Other public and private agencies and forest industries have joined in the work. Here are just a few of the many accomplishments of Forest Service research:

Forest lands have been inventoried at intervals to determine trends in forest area, volume, and growth, and to appraise factors and programs affecting our forest resource.

In experimental watersheds, ways have been found to increase useful water supplies, as by special timber cutting and erosion control in areas of abundant snow or rainfall. In watershed research, a recent advance is a method for estimating more accurately how much land-improvement measures will help reduce floods.

From the start, firefighting methods have been a Forest Service specialty. By 1919, airplanes were used; by 1921, radio communication.

Pioneer techniques for delivering men and supplies by parachute aided our paratroop training in World War II. Now widely used is the Forest Service fire-danger meter, which rates temperature, humidity, wind velocity, and other factors in fire spread.

Research on timber-killing insects—worse foe than fire—has developed effective insecticides and ways to use aircraft and mist blowers in applying them. Atomized sprays 100 times more concentrated than ordinary mixtures have made small amounts of strong pest killers effective over wide areas.

A woody-plant seed manual has summed up for forest-tree seed sup-

pliers and nurserymen facts from years of research on methods of seed collection, storage, treatment, germination, and other procedures. Included are 444 species.

Hybrid pines were Forest Service news in 1930. Since then, many tree crosses have been bred for superior stock, some quick-growing, some resistant to an insect or disease. To date, the Institute of Forest Genetics has produced 65 pine hybrids, many of which have already exhibited outstanding characteristics.

Seed farms are now being established to propagate these superior trees, with the seed being produced by either controlled or wind pollination of the superior parent.

Pioneering in research to control lumber drying, Forest Service workers invented the internal fan system. This now speeds seasoning, reduces wood waste, and improves quality.

Need for pulp sources to supplement spruce, fir, and hemlock was foreseen long ago, and Forest Service scientists experimented with pulping on more than 100 woods. One result was the launching of the South's pine-pulp industry. Considering low-value hardwoods for pulp, researchers devised usable processes—part chemical, part mechanical. And refuting the adage that pulps shouldn't be mixed, they made good pulp by a new cold caustic soda process using mixtures of some 20 Texas hardwoods blended with some southern pines.

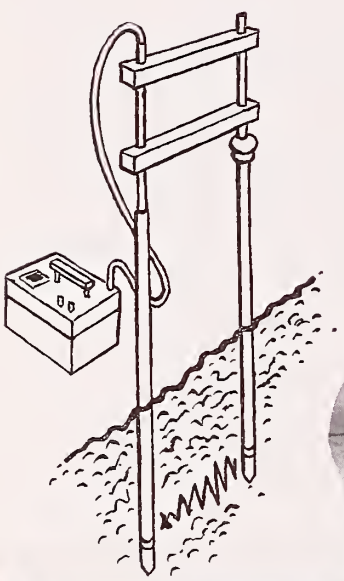
Steam distillation methods devised nearly 30 years ago revolutionized production of gum and turpentine from pines. Another naval-stores advance was spraying sulfuric acid on the cuts. This prolongs gum flow so that chipping can be done at 2-week intervals, instead of weekly.

Glues and gluing techniques developed at the Forest Products Laboratory have made possible a whole new branch of woodworking. By bonding boards with water-resistant glue, scientists showed that laminated structural members—both straight and curved—could be used in building auditoriums, factories, aircraft hangars, barns, bridges, and ships.☆

327674°—55

MOVING IN ON Soil

COMPACTED SOIL at right restricts roots—which holds back plant growth and productivity. In loose, friable soil at left, roots get moisture and nutrients under the cultivated layer.



SCIENTISTS ARE READY, too. One reason is new densitometer; it uses gamma-ray absorption for easier soil-density measurement.

FARMERS ARE READY to do something about soil compaction, now that they have machines such as this hydraulically controlled subsoiler. Breaking up deep hardpan layers takes heavy implements, adequate power.

compaction

FARMERS AND RESEARCHERS ARE SET TO DO SOMETHING ABOUT IT

A NEW ERA IS BEGINNING in research work on soil compaction and hard pans—physical conditions that often reduce crop yields.

These compacted soil layers may be "induced"—as by tractor and implement traffic over cultivated land, or "genetic"—through development of the soil itself.

Spurred by growing concern with the problem, USDA and cooperating agencies around the country have launched a broad program of experimental work in varying soils, conditions, treatments, and implements.

The move recognizes that physical properties of soil have become a more limiting factor to production with the increased use of new fertilizer practices, new insecticides, new crop varieties, irrigation, drainage, and other means of increasing output. It also recognizes that the problem is growing steadily as traffic increases over cultivated land through mechanized farming and more cultivation. Further, the move takes note of the fact that many farmers now have at hand the heavy power and tillage machines to do something about the problem.

Research also is now in a position to do something about the problem, thanks to several important advances. One is the recent development by a New Jersey soil physicist of a "densitometer," which uses gamma ray absorption for quick, accurate measurement of soil density. Another step is the work of a joint committee that has been set up by the American Society of Agricultural Engineers and the Soil Science Society of America to define terminology used in soil-compaction studies. Then, too, teams of agronomists, engineers, and soil physicists have been organized to work together on this problem.

These developments are removing roadblocks that once stymied the progress of soil-compaction research.

Core-sampling, for example, is laborious, and reliable measurements are hard to get in certain soil conditions. Tests with the new densitometer take little time and effort and can be made as often as necessary to follow the change in soil conditions after treatment.

The joint committee's efforts in clarifying terminology should help in the interchange of research results among the different workers involved in this problem.

Teamwork by the scientists will make possible far more detailed studies of soil compaction and a closer evaluation of relationships between soil chemistry and physics, management, productivity, and tillage operations.

At the ARS Tillage Laboratory at Auburn, Ala., the mechanics of soil disturbance will be studied. The laboratory is well-equipped to test commercial tillage machines, improve them, and develop others. Much research can be done at Auburn with small scale model machines in a special laboratory that's set up for testing and evaluating the machines under known conditions.

It has been known for years that compacted soils inhibit plant root growth and moisture penetration. Early efforts to relieve these conditions led to the conclusion that sub-soiling yields little worthwhile result.

More recent studies show that deep-tillage treatments that shatter induced pans or compacted layers may increase crop yields in certain years, but the benefit may last only a single season. Deep tillage alone hasn't been very successful on claypan soils. Deep tillage, plus deep placement of lime and fertilizer, may be beneficial, but its advantage over placing lime and fertilizer in the normal plow layer is in question. Compaction research thus far doesn't justify any generalization on the effects of deep tillage on many different soils.

Through Federal-State cooperation, it's possible to coordinate studies and handle problems according to soil and agricultural areas. The scientific-team approach and new techniques and equipment will help.

When all these forces are brought to bear, we may expect answers to many important questions:

(1) What soil conditions respond to deep-tillage operations? (2) How long does the effect of such treatments last? (3) Should amendments, such as lime and fertilizer, be placed in the fractured zone? (4) How can amendments best be placed? (5) Should rotations be established to provide an occasional sequence of deep-rooted legumes to penetrate and help hold open the fractured soil horizons? (6) What chemical and physical factors that limit plant growth on different soil types may be effectively treated? (7) What types and designs of equipment are best suited to give maximum physical results? (8) Can the development of compacted layers be prevented by the use of deep-rooted crops, or by eliminating certain common tillage operations?☆

Shade cloth that lasts

SUN-RESISTANT COTTON CLOTH that can be used at least 3 years to shade tobacco is demonstrating its commercial value in north Florida.

This durable cloth is now being marketed by two textile finishers, and others are watching its progress. One finisher processed a million square yards in 1954 and plans to make 3 or 4 times that much this year.

Used only for cigar wrappers, shade-grown tobacco covers some 12,000 acres in Florida, Connecticut, and Georgia. Research to develop a treatment that would make cotton shade cloth last longer began in 1947 when Florida growers appealed to USDA for help. Farmers like cotton because it's less expensive and easier to handle than synthetics—and stronger than some. Much of its strength is lost, however, after only one season.

Previous cotton research that pinpointed ultraviolet rays as the most damaging factor in solar radiation helped chemists develop the sun-resistant cloth. What could render these rays ineffective? The answer was found in lead chromate, a mineral pigment, by ARS chemist J. D. Dean and associates of the Southern Regional Research Laboratory. Later, chemists W. N. Berard, C. F. Goldthwait, and others cooperated with cotton manufacturers to adapt the inexpensive treatment to commercial use.

The cloth can either be soaked in an emulsion containing lead chromate and resin, or go through a two-bath treatment in which it absorbs the main elements of lead chromate separately (lead acetate, followed by potassium or sodium dichromate). The 200-inch-wide cloth is folded to permit treatment on standard textile equipment.

Tobacco farmers field-tested 50,000 square yards of the improved cloth in Florida from 1951 to 1953. It weathered all 3 seasons without replacement, and retained 25 percent of its original strength.

This treated shade cloth costs about 2 cents more per square yard, and it takes 5,000 square yards to cover an acre of tobacco. Yet the growers save about $200 per acre each year it can be reused.

Chemists are now working on problems of other growers. In Connecticut, where the sun is less intense, most shade cloth lasts only 2 seasons and can't be salvaged for a third. It has to be about half the weight of Florida-type cloth so beneficial rays can penetrate. Cuba's humid climate calls for a cloth resistant to mildew as well as solar radiation.

Research has also started on a lead chromate treatment for seed-bed cover, which must be rotproof as well as sun-resistant.☆

FLAX right variety at right time

SEEDING the right variety at the right time makes a big difference in North Dakota flax yields, says USDA plant pathologist H. H. Flor.

Flor recently completed 6-year tests of different flax varieties in cooperative research by ARS and the North Dakota experiment station at Fargo. He found that the varieties Redwood and B5128 yield best in early sowings (April 25–May 15); Royal, Rocket, Victory, and Viking are best in intermediate sowings (May 16–June 5); and Bison, Dakota, Koto, Marine, Sheyenne, and an experimental variety, CI1478, excel in late sowings (June 6–July 7).

Flax is sown in the North central States from April to early July. Yields usually are bigger with early sowings that enable the plants to escape midsummer heat and drought.

But flax growers must often make late sowings because an early-seeded stand fails, or because several crops need to be planted at the same time. Sometimes heavy weed growth or early drought forces late sowing. Then, too, flax is the best cash crop that's available for late sowing in North Dakota and northern Minnesota. It rarely gives a bumper crop, but it does well when late July and August are fairly cool.

If late sowings must be made, a short-season flax variety like Shey-

enne or Marine is a grower's best bet, according to Flor. Long-season varieties such as Redwood and B5128 need early sowing that gives them time to develop before the arrival of hot weather—flax's worst enemy.

Short-season varieties don't yield as well as long-season flax that's sown early, but the short-season varieties are good in late sowings because they develop fast.

In Flor's experiments, for example, B5128 averaged 22.1 bushels per acre in early sowings, 17.0 in intermediate sowings, 10.6 in late sowings (June 6–20), and 2.8 in very late sowings (June 21–July 7). Sheyenne averaged 19.5 bushels in early sowings, 19.1 in intermediate sowings, 16.3 in late sowings, and 9.4 bushels per acre in very late sowings.☆

LIME waste product is good source

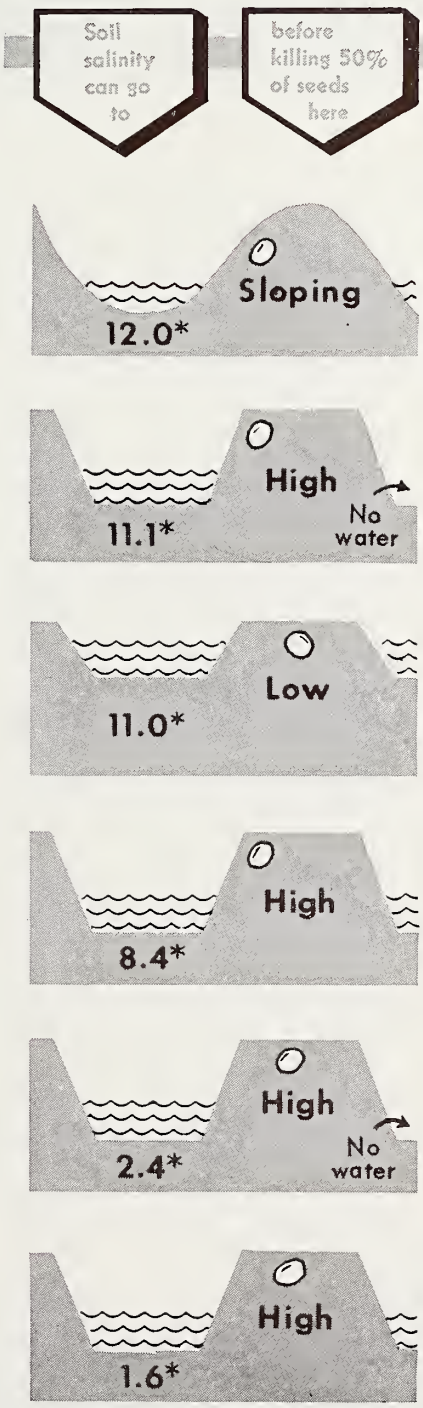
BROWN MUD, a waste material produced in extracting alumina from bauxite, may become a new and economical source of agricultural lime.

In greenhouse experiments at the USDA Plant Industry Station, Beltsville, Md., brown mud proved comparable to such standard materials as ground limestone and hydrated lime.

As a corrective for soil acidity, it was as effective as ground limestone. Normal liming with brown mud produced no toxic effects on sweet clover plants. Emergence, growth, and yield of sweet clover grown in initially acid soil limed with brown mud were excellent—equal to results from regular liming materials.

ARS soil scientists say brown mud normally contains 47 percent lime (calcium oxide). Alumina extractors wind up every year with about a half-million tons of brown mud in waste ponds at their plants.☆

HOW TO SAVE SEEDS FROM SALT



*Millimhos per centimeter, the measure farmers use to gage a soil's salinity. This represents a soil solution's capacity to conduct an electrical current. Plant injury, like electrical conductivity, rises as salt builds up in the soil.

SEEDS on the sloping shoulder of a well-rounded seedbed get the best chance to germinate and emerge on irrigated saline soils of the West.

This USDA discovery broadens the opportunity for farming western soils that have salted up through years of irrigation. Heavy plant loss at the sprouting or seedling stage causes sparse, irregular stands and necessitates overplanting.

ARS researchers L. Bernstein at the Salinity Laboratory, Riverside, Calif., and A. J. MacKenzie and B. A. Krantz at the Southwest Irrigation Field Station, Brawley, Calif., did the work. They found that soybeans planted on a slope 1 inch above irrigation level tolerated *4 to 7 times* as much salinity as seeds planted on the center of a high flat bed, 4 inches above water—that is, *4 times* as much when the flat bed was watered on one side only, *7 times* as much when it was watered on both sides.

Salt in irrigation water seeks the highest ground farthest from the watered furrow. It is deposited there by evaporation. That's why you get into trouble planting on the center of a high bed, especially if it is watered on both sides as usual.

Where the high flat bed is used, the shoulder is the best position for seeds. In fact, it is almost as good as the sloping bed if water is supplied on only the one side nearest the seeds. Then salt largely passes beyond the seed row.

A low flat bed, standing 1 inch above the irrigation water level, offers almost as good environment as the high sloping bed, since there is no pronounced tendency for salty water to be drawn to the center.☆

HERE'S THE Beltsville Broiler

YEARS OF BREEDING AND SELECTION HAVE GONE INTO THIS BIG, FAST-GROWING CROSSBRED

AT A TRI-COUNTY FAIR in West Virginia last fall, a quarter-million broilers were sold at auction. One kind outsold all others and brought its growers premium prices. It was the Silver Cornish-New Hampshire cross, developed originally at USDA's Agricultural Research Center at Beltsville, Md.

Typical of crosses this new bird isn't a breed. It must be produced by mating the new Silver Cornish, also developed at Beltsville, and New Hampshire stock. The best characteristics of these parents are reproduced only in the first generation.

Nevertheless, the new Beltsville broiler—which grows from a chick to a 3-pound broiler in less than 10 weeks—may become as famous as the Beltsville Small White turkey.

Experimental breeding for development of superior meat-type breeds and crosses began at Beltsville in 1948 under ARS poultry geneticist C. W. Knox. At that time, a wax model was made of the "ideal" meat-type chicken—a mark at which Knox and his coworkers could shoot. Now the wax model is gone. In its place are live and dressed birds of several breeds and crosses that are superior to their waxen image in every respect.

The researchers sought a market bird that was light in color—such birds are easier to dress—one that feathered out quickly and grew rapidly. They wanted a bird of good conformation that would produce a maximum of meat in a 10-week period and more eggs annually than most meat-type breeds normally lay.

They had a breed that met some of these requirements—the New Hampshire. It feathered quickly and grew rapidly but its feathers were dark and its conformation and egg-laying ability left something to be desired. The scientists wanted a "silver" bird that could be mated to the New Hampshire to produce a cross of the proper color. So they developed the Silver Cornish breed from a long list of ancestors that included White Wyandottes, Light Sussex, Rhode Island Reds, Dark Cornish, and Columbians. Before actual crossing was attempted, however, the geneticists spent more than 5 years improving the two basic breeds. Selected were birds that feathered out quickly, that showed superior meat-making ability, and produced more eggs. The work of breeding and selection was "standardized" in an effort to remove the variables—factors other than breeding and selection—that could cause changes in feather, meat, and egg production.

Growth-progress checks were made regularly as each lot of birds became 10 weeks old. The chickens were supplied with normal rations, containing vitamin D and a supplement of riboflavin, but the geneticists avoided using the so-called "high-energy" feeds containing antibiotics and similar compounds.

Through breeding and selection, the scientists reduced substantially the time required for growing these two key breeds to broiler weight. And the progeny of the New Hampshire-Silver Cornish cross outdid the parent stock in rate of gain.

Then there was the problem of egg production, always relatively low in meat-type chickens. But breeding and selection built up production in meat-strain New Hampshires to an average annual output of about 175 eggs as compared with an average of about 200 eggs in good-egg-strain New Hampshires. Egg-production in the Cornish hens was built up to an average of about 185.

Improvement was sought along other important lines as well. The geneticists wanted the parent stock to have better conformation, compactness, breast width, length of keel bone, and depth of body. Careful checks on progress were made with specialized instruments that measure such development and permit continuing comparisons with previous data obtained in the same manner.

The improved New Hampshire and Silver Cornish strains were crossed for several reasons. One was to develop a new meat bird that would carry the best points of both parents. Another was the fact that crossbreds usually have greater survival ability under intensive commercial production conditions. Then, too, such a cross would produce the light feather color most desired by broiler growers because such birds have more sales appeal. Still another point was that the New Hampshire breed predominates among broiler growers and breeders. This meant that breeders could provide eggs of the crossbreds by purchasing Silver Cornish males to run in flocks of New Hampshire hens.

In addition, the geneticists embarked on another plan of breeding that offers advantage to producers who buy sexed chicks. The scientists made use of known facts concerning sex linkage of color genes in crossing New Hampshire *males* with Silver Cornish *females* to produce chicks that show sex difference by *down* color: the male chicks have the light coloration of their female parents; the female chicks show the red color of their male parents. In the adult stage, the males have plumage similar to the Silver Cornish and the females resemble the New Hampshires. (*All* adults produced by crossing male Silver Cornish and female New Hampshire stock resemble the Silver Cornish breed.)

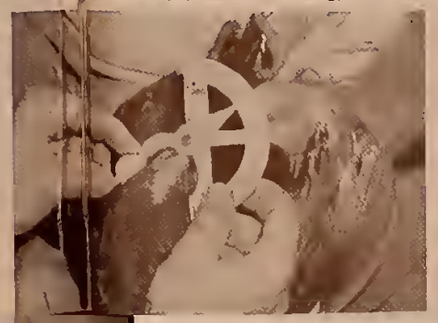
The sex-color development was planned as a part of the breeding work, because it eliminates the expense of sexing chicks. Broiler raisers often prefer males because they grow larger and gain faster than females. Selection by color makes it easy for a producer to buy "straight-run" chicks and grow them separately when economic conditions warrant the practice.

All this has created a demand for the new Silver Cornish that's far greater than the supply. When available, limited numbers of eggs (usually in lots of 6 to 9 dozen) are sold to breeders and distributed to cooperating State experiment stations. The chicks are crossed with purebred New Hampshires to produce the Beltsville-developed cross for commercial use.

As with any new breed, further work is needed to reduce variations between individual members of the families and to increase the desirable characteristics of the foundation stock. So breeding and selection are being continued in the new Silver Cornish, along with research on other meat-type chickens.☆

MEATY, LIGHT-COLORED bird shown dressed is made by this cross. The reverse—New Hampshire male and Silver Cornish female—gives males that resemble Silver Cornish, females that resemble New Hampshire.

BREAST development of bird is checked by special caliper. Silver Cornish and New Hampshire parent stock were improved by years of breeding, selection.



KEEL BONE length is measured. By taking such measurements on each lot of chicks at 10 weeks, geneticists check progress in improving parent stock.

BODY depth is recorded. Along with more meat, breeders also wanted better egg production and quicker feathering in parents.

A NEW INTERPRETATION OF THE BRUCELLOSIS TEST CLEARS MANY VACCINATES

NEW DISCOVERIES about the interpretation of the blood test for brucellosis in cattle should save many disease-free animals from being classed as brucellosis reactors or suspects as in the past.

The cattle to be thus saved are those previously vaccinated at about 8 months of age with Strain 19 *Brucella abortus* vaccine. It has been shown that the standard interpretation of the test—though reliable for animals that have *not* been vaccinated—gives biased results when used for previously vaccinated animals tested at 30 months or more of age.

Vaccination causes buildup of antibodies or agglutinins in the animal's blood, a condition that occasionally persists into adulthood. And these same antibodies, usually more plentiful in brucellosis-infected animals, cause the test reaction that shows up the disease. Through recent studies, this problem has been clarified by interpreting differently the reactions in vaccinated cattle as compared with reactions in animals, that have not been vaccinated.

To conduct the blood-agglutination test, a small amount of the animal's serum is added to a test fluid (antigen) that contains dead *Brucella* bacteria. If the serum contains *Brucella* antibodies, a visible clumping of the bacteria occurs.

Until now, tests for both vaccinated and nonvaccinated cattle have been interpreted alike: Where complete clumping occurs at the 1:100 dilution (1 part of serum to 100 parts of antigen or its equivalent) the animals are classed as reactors. Where the clumping is incomplete at the 1:50 dilution to the 1:100 dilution, inclusive, the animals are considered to be suspects.

Recent studies on adult cattle, the majority of which had been vaccinated as calves, were made by ARS researchers E. R. Goode, Jr., T. E. Amerault, and C. A. Manthei in cooperation with livestock sanitation officials of Illinois and New York State. The milk of all animals that showed significant reactions to the blood test was examined for the presence of brucellosis infection. This procedure was used since practically all brucellosis-infected cattle harbor the infection in the udder.

The researchers demonstrated that a calf-vaccinated animal showing reactions in dilutions of less than 1: 100 is equally as safe as a nonvaccinated animal showing a reaction in dilutions of less than 1: 50. They showed that the risk of classifying animals as suspects is no greater for calf-vaccinated animals showing a range of reactions from an incomplete reaction at the 1: 100 dilution to an incomplete reaction at 1: 200, inclusive, than for nonvaccinated animals showing reactions from an incomplete at 1: 50 to an incomplete reaction at 1: 100, inclusive.

Also, the degree of infection in calf-vaccinated animals with a complete reaction in the 1: 200 dilution was almost identical to that in nonvaccinated animals with a complete reaction in the 1: 100 dilution.

These findings have resulted in development of an alternate interpretation that increases the diagnostic level for animals vaccinated as calves *one whole dilution* over the level for animals not vaccinated.

The present and the new interpretations of the blood test were each applied to data from the same cattle vaccinated in calfhood. The new interpretation showed 500 percent more negative animals, 300 percent fewer reactors, and nearly 40 percent fewer suspects. Yet, *Brucella abortus* was not isolated from any animal identified as negative.

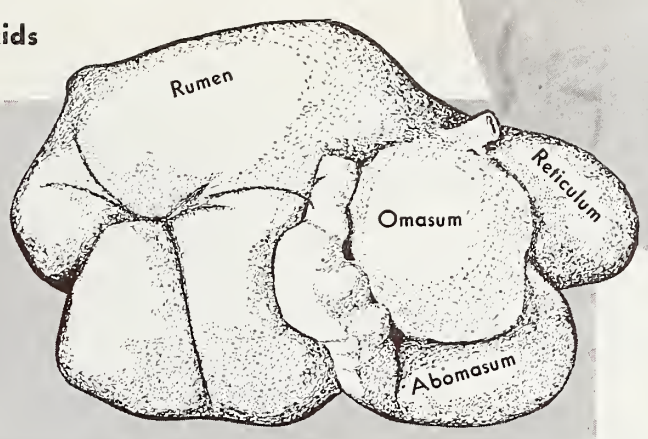
The new interpretation has been offered to and accepted by the United States Livestock Sanitary Association. When put into effect, it should give a more accurate means for detection of infected calf-vaccinated adults. Less manpower will be involved in keeping fewer suspect animals under surveillance and farmers will learn more quickly the brucellosis status of their herds. Moreover, some shipping problems will be reduced.

The livestock industry will reap the greatest benefit from this new interpretation only if calves are vaccinated at the recommended age of 6 to 8 months. Vaccination at later ages reduces proportionately the chance of brucellosis-free animals being classified as negative when they are tested as adults.

Interpretation of the blood-agglutination test won't be changed for cattle that haven't been vaccinated.☆

Fiber-breakers need certain fatty acids

GROWTH FACTORS FOR RUMEN BACTERIA



BACTERIA *B. succinogenes* (right) may number billions in a bit of rumen fluid. These bacteria and helpers break up rough feed in rumen-reticulum, ready for further digestion in omasum. Final digestion and assimilation take place in abomasum—cow's true stomach.

A BIG NAME for certain small bacteria found in the rumen of a cow is *Bacteroides succinogenes*. When Bossy eats a good meal of low-fiber feed, these tiny, rodlike bacteria just relax. But when the ration has a high fiber content, these organisms swing into action. They break down the cellulose to make special feeds on which they thrive and multiply, as well as energy-giving end products for the cow.

These bacteria help make it possible for ruminants—cattle, sheep, goats—to live on coarse, high-fiber feed. Material aid also comes from rumen bacteria known as cellulolytic cocci, and some assistance from at least two other groups.

B. succinogenes were isolated in rumen fluid in 1947 by R. E. Hungate of Washington State College. Now we learn that certain volatile fatty acids in the rumen liquid are essential growth factors for these bacteria. This important discovery was made by USDA bacteriologist M. P. Bryant, and associate Raymond Doetsch of the University of Maryland. A piece of good fortune is the fact that these acids are available from commercial laboratories compounding them for experimental purposes.

The findings are leading to new feeding tests at USDA's Agricultural Research Center at Beltsville, Md. Better knowledge of feed use may result. But that's another story.

Bacteriologists at Beltsville are investigating the kinds of bacteria present in rumen fluid as part of basic research into ruminant nutrition. The functions of some—*B. succinogenes* among them—are known. But rumen fluid crawls with bacteria. Some contribute to the cow's welfare, some do not. Exact functions of many are still to be determined.

Starting with *B. succinogenes*, Bryant set out to find the growth factors that are responsible for natural reproduction of the organisms in numbers sufficient to carry on their functions in the rumen.

These bacteria proved hard to please. They wouldn't give the expected response when Bryant attempted to grow them in rich media in which fastidious non-rumen bacteria thrived. He tried special media, fortified with many known growth factors such as B vitamins, minerals, and amino acids. These trials earned no worthwhile response—but they did prove to Bryant that he was dealing with an unknown growth factor.

The bacteria flourished on something in the fluid. What was it? Bryant fractionated the rumen fluid into various components and tried them one by one, in a medium containing many known growth factors. His patience was eventually rewarded.

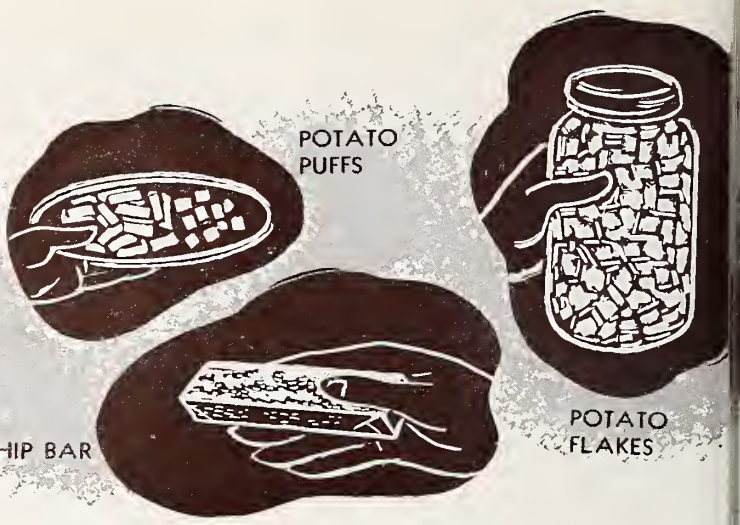
What *B. succinogenes* demanded was certain volatile fatty acids. One group—n-valeric and n-caproic—were *straight-chain* acids; the other group—isobutyric, isovaleric, and DL-alpha-methyl-n-butyric—*branched-chain* acids. Bryant found it took a combination of any one of the straight-chain acids with any one of the branched-chain acids.

He also found that n-caprylic and n-heptanoic acids—not found in rumen fluid—will work well with any of the branched-chain acids. Strangely enough, acetic, propionic, or n-butyric—straight-chain acids abundant in rumen fluid—won't serve as the straight-chain acid component to let the organism grow.

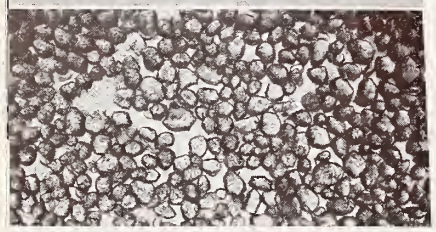
Research to determine the practical value of these newly discovered growth factors will be started soon at Beltsville. Calves will be given the combined acids in varying quantities, along with semi-synthetic feeds. Other calves will get these same feeds without the acids.

The scientists hope to find out whether these acids are an aid to nutrition, or whether a healthy animal is supplied with enough through natural processes.☆

It's done with POTATOES

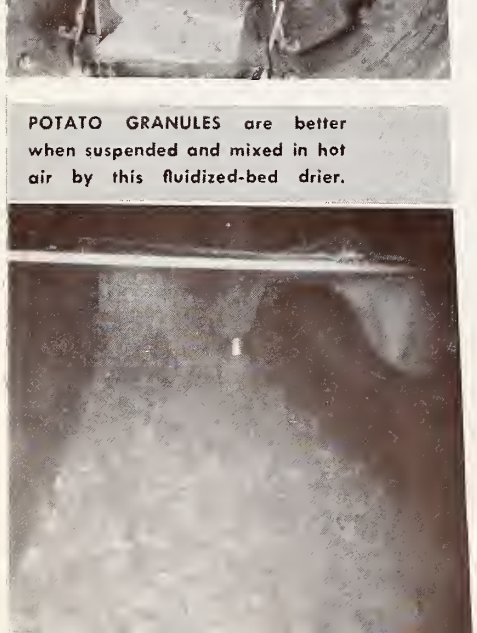


POTATO CELLS are protected in new flake, granule methods. Rupture of cells makes product pasty.



POTATO FLAKES are formed as this carefully controlled sheet of mash is steam dried, then broken.

POTATO GRANULES are better when suspended and mixed in hot air by this fluidized-bed drier.



FOUR NEW PROCESSES POINT TO GREATER USE

DRIED POTATOES in new flake form . . . a new process for drying potato granules (dehydrated mashed potatoes) to a very low moisture content . . . potato puffs, an unusual potato tidbit . . .and potato-chip bars . . . these are the latest USDA advances to increase the use of our most important vegetable.

Although preservation of potatoes by drying dates back 2,000 years or more, development of new and improved processes for dehydrating this vegetable has been fairly recent.

From the ARS Eastern Regional Research Laboratory comes a new form of dehydrated potatoes—potato flakes—which make delicious, fluffy mashed potatoes as quickly as you can mix with hot milk or water. Salt is added to taste, and light whipping gives a creamy texture. They have a subtle baked-potato flavor.

To make flakes, the potatoes are peeled, cooked, and mashed. Fed to a double-drum drier, this mash covers the surface of the rotating drums in a continuous film. It's then dried by steam, removed as a running sheet of carefully controlled thickness, and finally broken into flakes.

By this flake process, starch-cell rupture is held to a minimum, which keeps the product from being pasty. Storage tests must be completed before the method can be developed commercially. It should cost less than the process of making granules.

A continuous fluidized-bed drier developed at the Western Regional Research Laboratory makes it possible to produce acceptable granules.

Single or small clusters of intact potato cells, granules are desirable for their great saving of space and weight. But consumer acceptance has been slow. For one thing, the product was often pasty because processing ruptured the starch cells. Furthermore, too high a moisture content often caused off-taste and off-color to develop in storage.

The new drier lowers moisture to 3 percent—the previous low as 7 percent—which greatly improves storage stability. And by cutting impact and abrasion damage in processing, this method reduces pastiness.

In the new drier, hot air coming up through a porous plate suspends the bed of granules above the plate so that they move about like a boiling liquid. This continuous and thorough mixing insures even drying.

A fluidized-bed drier 3 feet wide and 14 feet long is in commercial use at one plant. It can finish about 1,000 pounds of granules an hour.

Western Laboratory researchers have also come up with a fat-free, pillow-shaped, puffed potato tidbit that can be flavored and has an attractive crunchy texture and toasted color. It's good for out-of-hand eating, as a breakfast food, and in soups, stuffing, and casseroles.

These puffs are made by blanching peeled potato strips in boiling water, then rapidly drying the surface and heating at the same time. Steam formed inside expands the strip.

Puffs may be flavored with such materials as cheese, garlic, onion, sugar, monosodium glutamate, and salt. Generally, these flavorings are added to the blanching water.

For a high-calorie, high-density military ration with taste appeal, the Eastern Laboratory has developed a bar from crushed potato chips. This occupies only a twentieth of chip volume. Binding is improved by using high-melting hydrogenated vegetable oils in the frying process.

The armed forces, restaurants, institutions, and housewives should find these dehydrated potato products of great value. They're convenient to prepare and store, as well as consistently high in quality. Up to now, the flakes, puffs, and bars haven't been made commercially.☆

WHAT ABOUT COTTON CARPETS?

SAMPLE RUGS lie before cafeteria counter for wear test. In 112 days, 42,000 persons walked over strips; they showed no signs of wear.

SMALL COTTON RUGS ARE OLD-TIME FAVORITES with homemakers, but cotton floor covering made on a broad loom in such widths as 9, 12, and even 18 feet, has been marketed in quantity only since 1950.

To answer many questions about this new type of floor covering, USDA home economist M. L. Hensley and textile physicist H. M. Fletcher put it through tests for durability, color-fastness, and shrinkage.

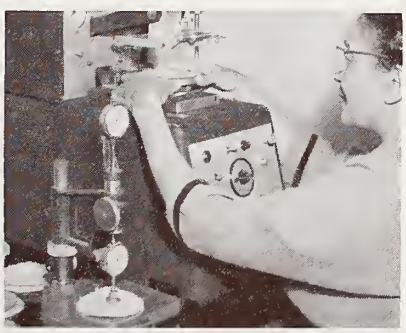
For a practical siege of hard use, samples cut from 12 commercial broadlooms—6 woven, 6 tufted—were laid in a cafeteria line (top).

As a laboratory check, samples were abraded on a wear tester (bottom, left). About the same amount of rubbing wore down the *least* durable tufted and the *least* durable woven rugs. Yet, the *most* durable woven samples stood twice as much rubbing as the *most* durable tufted samples.

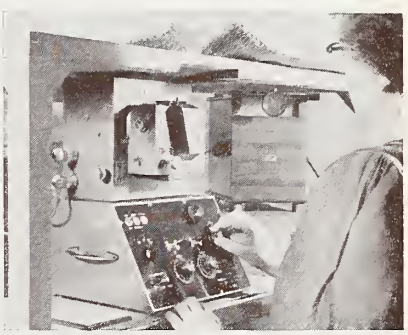
In fading tests (bottom, right), some of the rugs showed color changes. This usually occurred after the first period of wear and washing. For exact color matching, consumers should check this point when buying.

Shrinkage is important if broadloom is to cover a fixed area, as in wall-to-wall carpet. Of 6 tufted samples tested, 3 shrank less than 1 percent, which is a small amount in textile shrinkage. The other 3 tufted samples shrank not more than 3.6 percent. Woven samples shrank from 2.5 to 8.6 percent in length and from 0.7 to 2.9 percent in width.

Since the quality of this product does vary, the ARS researchers point out a need for rug makers to give consumers more informative labels or other information. This would help them choose goods that are satisfactory for their particular needs. Further experiments are planned.☆



WEAR is checked on wear tester (right). Rugs are rotated as abrader rubs back and forth. Gage (left) indicates pile height.



COLOR of broadloom samples is checked on a color and color difference meter before and after each wear period and washing.

fruits and vegetables

IRRIGATION

sprinkling brings disease problems

IRRIGATION IN THE COLUMBIA RIVER BASIN is bringing new crops and higher production to central and eastern Washington. But it's also bringing new plant disease problems, say USDA plant pathologists.

Mint, a new crop to this area, was found infected with the fungus disease mint rust for the first time this summer. Powdery mildew, another less common but potentially damaging disease of mint, was noted infecting peppermint and spearmint throughout the Yakima Valley.

Serious diseases have also been found on sprinkler-irrigated beans. Bean rust is spreading, and outbreaks of pod rot and root rot are exceptionally heavy.

In their search for control measures, ARS scientists are finding that the type of irrigation practiced can affect the occurrence and spread of certain diseases. The diseases mentioned above have been confined almost entirely to sprinkler-irrigated fields.

ARS plant pathologist J. D. Menzies carried on tests in cooperation with the U. S. Bureau of Reclamation at Winchester, Wash. These proved that sprinkler-type irrigation spreads bacterial diseases of beans whereas furrow irrigation does not. Menzies believes, however, that as long as bean crops in this area are planted early enough to be harvested before October, sprinkler irrigation probably won't cause serious crop loss.

Test plots of sprinkler-irrigated lima and field beans, inoculated with common blight, leafspot, halo blight, and wilt, often showed a rapid spread of disease from the primary infection—but late in the season *after* crops were mature. When greenhouse tests demonstrated that even a short sprinkling period spreads blight if active bacteria are present, it was concluded that summer heat probably kills most of the bacteria between irrigations. Disease spread is thus limited to cooler weather in the fall.

How does sprinkler irrigation spread disease? Sprinklers undoubtedly produce higher humidity around plants than do furrow applications, but this is temporary. The important thing is that the splashing of water from leaf to leaf spreads disease organisms and probably causes minute injuries that encourage infection.☆

CHERRIES

orchard to plant by water tankers

RESEARCHERS HAVE COMPLETELY ELIMINATED the need for lugs and lug handling in assembling and transporting red cherries in Michigan. How? The fruit is loaded right into water tank trucks in the orchard and moved directly to the processing plant.

Earlier experiments brought about successful water-handling of cherries from receiving station to processing plant (see AGR. RES., June 1954, p. 15). But lugs, which are costly to buy and maintain, were still needed in getting the cherries to the receiving station.

This new method—orchard-to-processing plant—was tried out experimentally last season by USDA engineer J. H. Levin and Michigan experiment station horticulturist H. P. Gaston. Here's the process:

The cherries are picked in pails, which are loaded on an orchard trailer and hauled to a loading dock in the orchard. Here the fruit is emptied onto a sorting table and moves across into a tank truck filled with cold, circulating water. Finally, the trucks are driven to the processing plant where the cherries are flumed into holding tanks. The trucks are then refilled with water for the return trip to the orchard.

Both growers and processors benefit from the elimination of lugs. Growers are able to reduce labor costs, maintain on-the-tree quality, and deliver higher-grade fruit. At the same time, processors can produce a high-quality pack of cherries at less cost through faster handling, lower unloading costs, and savings from not having to supply and maintain lugs.

Up to 25 million pounds of cherries are expected to move by water-handling in Michigan this year.☆

DIRECT from orchard on tractor-drawn orchard trailer, cherries are dumped from pickers' pails onto table for quick-sorting. Water tank trucks carry fruit to the processing plant. This eliminates the use of lugs and the need for handling them at receiving stations

livestock

FOR FAMILY FARMS Sheep

RESEARCH SHOWS that sheep are bringing added income to small or medium-sized family farms. Many are in need of more income these days.

Farm-management studies made on irrigated farms in Montana by USDA in cooperation with the Montana experiment station showed that sheep may be an important supplemental enterprise where cash-crop acreage has been cut or prices are down.

ARS economist D. C. Myrick found that most of the flocks had been started to use idle land—some of it not quite good enough for cash crops—or to use surplus forage. Farmers interviewed said that their flocks take little time away from other enterprises, since sheep need most attention in winter. Myrick thinks sheep would be equally adapted to family farms with similar feed or land situations almost anywhere.

The average flock in the study, 60 ewes and 2 rams, annually returned $1,300, or $21.70 per ewe. Of this, $864 came from sale of the lamb crop, $64 from culling old ewes, and $374 from fleeces. That's counting a crop of 72 lambs—60 of them sold at 80 pounds for 18 cents per pound, and the others kept as replacements. And there were 68 fleeces in these flocks averaging 10 pounds and currently worth about 55 cents a pound.

Flocks on those Montana farms varied in size, of course, just as the farm situations varied. Generally a small start was made, sometimes with 20 ewes or less, and frequently with good but low-priced old range ewes. That's a safe procedure for a man who is experienced with sheep, but for the beginner, the added cost of healthy young ewes proved to be profitable. Purebred rams noticeably upgraded the quality of some grade flocks during the period under study.

Sheep need shelter in Montana, especially at lambing, but it need not be expensive. Good drainage around barns, lots, and pastures can help keep down disease and parasites.

Minimum fencing (32-inch woven wire and 2 strands of barbed wire) for the average 20-acre irrigated pasture cost $550 or more. That included a cross fence. Where dryland was pastured, more fencing was needed per sheep, but less per acre, the size and cost depending on the amount and quality of forage.

Sheep lived well on forage, including crop residues, that most other livestock leave. They got much good grazing in harvested fields, along ditch banks and field borders, and on wasteland. Even in Montana, sheep could graze some in midwinter. In some parts of the country they can graze throughout the year.

Flocks in this study were barn-fed 60 to 120 days in winter. Since hay was the mainstay, good quality, notably legumes, proved worthwhile. The sheep also got a small supplement of grain starting 2 to 6 weeks before lambing and continuing in larger amounts until pastures freshened.

This study shows that sheep offer a good prospect for added income for family-size general farms.☆

Readers' REACTIONS

Puff

SIR: One article in your December issue appealed to me as something we should bring to the attention of our readers in Dakota. It is your two-page center spread, "War with Wind."

We aren't especially bragging about it, but we probably have as much wind in Dakota as any place in this country, and without a doubt interest in shelterbelts is probably as great.—W. W. MARTIN, Editorial Manager, The Dakota Farmer, Aberdeen, S. D.

● Glad to send glossy prints and more information on this work.—ED.

Question

SIR: We would appreciate more detail on the research reported in "It Takes Good Forage" [Nov. 1954, p. 12].—R. F. HUTTON, Assistant Professor, Farm Management, The Pennsylvania State University, State College, Pa.

● Further details on this subject can be found in these publications: BDI–Inf–164, Feeding Dairy Cows for Efficient Milk Production; BDI–Inf–141, Milk for the Future and How To Get It; and USDA Technical Bulletin 815, Input-Output Relationships in Milk Production.—ED.

Report

SIR: A copy of the November issue of Agricultural Research arrived today and I note where the USDA-sponsored Agricultural Aviation Conference will be held December 3 in Chicago.

If you plan to have press releases (and photos), we will appreciate receiving same.—W. BETTERSWORTH, Livestock Weekly, Memphis, Tenn.

● A complete printed report on the Agricultural Aviation Conference will be published by Agricultural Research Service. This report was compiled by J. Roy Allgyer, ARS coordinator who served as chairman, and should be available shortly.—ED.

UNITED STATES GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS, WASHINGTON 25, D. C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID PAYMENT OF POSTAGE, $300 (GPO)

agrisearch notes

CATTLE GRUBS have been controlled effectively by both internal and external means in recent experimental treatments by USDA. Though these results against heelfly or gadfly grubs are only tentative, they're encouraging.

At the ARS Animal Disease Laboratory, Auburn, Ala., phenothiazine was given free choice to cattle—1 part of it by weight to 3 parts each of bonemeal, limestone, and salt. Moving in the blood, it kills grubs at an early stage. In a limited test, 6 treated cattle averaged only 8 grubs; 6 untreated ones, 36 grubs. This success with a systemic opens up wide horizons in animal-parasite control, as free-choice phenothiazine already is standard control for gastro-intestinal roundworms.

A chemical designated as compound 21/199 (technically, 3 chloro-4-methylumbelliferone *0,0*-diethylthiophosphate) was sprayed as an 0.5 percent solution on backs of grubby cattle at the ARS Entomological Laboratory at Corvallis, Oreg. Trace amounts penetrated grub holes and killed all grubs (245) within a week. Possible toxicity is to be checked. (See also AGR. RES., Aug. 1954, p. 14.)

FOUR INSECTICIDES, organic phosphate types, each in an attractive bait, have given nearly perfect experimental control of flies in USDA experiments. These flies had resisted the traditional control measures.

In a rendering plant processing dead animals and slaughterhouse refuse, ARS entomologists J. C. Keller, H. G. Wilson, and C. N. Smith killed 99 percent of the flies within 4 hours with a malt bait containing 1 percent of the new insecticide known as compound OS–2046. Blowflies predominated there.

The same bait and another, 2 percent malathion in malt, killed 97 to 99 percent of the blowflies and houseflies in a city garbage dump in 24 hours.

Chlorthion—1 percent in malt—killed 90 percent of the flies on trash and garbage piles after 5 daily treatments. It had already shown up well in dairy barns. A 0.2 percent solution of the chemical L 13/59 in sugar water and 2 percent malathion in blackstrap molasses did almost as well.

SOIL'S EFFECT ON CROP NUTRITION, and in turn on animal and human nutrition, will be discussed by leading scientists at a 3-day symposium at Michigan State College, East Lansing, Mich., Feb. 14 to 16.

This is one event in the College's Centennial Year Commemoration. Scientists can register through the Continuing Education Service at the College.

The symposium is designed to resolve the many divergent opinions as to the effects of a soil's nutrient character on the nutritional value of crops grown on that soil. It is intended primarily for professional people.

Of special interest is the State experiment station's 10-year study of matched dairy herds reared on a poor-land farm. Part were fed from adequately fertilized fields, others from nonfertilized fields. The cattle's feed consumption, health, reproduction, and milk yield and quality were recorded.

ELEVEN NEW MOSQUITO REPELLENTS tried in recent USDA tests proved better than any now in use. All look promising but are unlikely to be on the market for some time.

ARS entomologist C. N. Smith and associates found that one chemical called compound 20218—known chemically as N,N-diethyl-m-Toluamide—is far superior to standard repellents against the yellow-fever, salt-marsh, and glades types of mosquitoes.

Compound 20218 prevented bites by yellow-fever mosquitoes for nearly 3 times as long as did a standard repellent. It prevented bites by salt-marsh mosquitoes for nearly twice as long as the standard repellent. It prevented bites by glades mosquitoes for nearly a third longer than the standard repellent did. And against malaria mosquitoes, compound 20218 protected the experimenters equally as well as the standard repellents.

The 10 other experimental repellents were each superior for at least 1 type of mosquito.

U. S. GOVERNMENT PRINTING OFFICE: 1955